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Results of forest insect and disease surveys in the NORTHWESTERN REGION of Ontario, 1986

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

D. C. Constable and E. J. Czerwinski
Miscellaneous Report No. 48

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THE GREAT LAKES FORESTRY CENTRE

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For many years the research program was guided by the Canada-Ontario Joint Forestry Research Committee, made up of senior members of the Centre and the Ontario Ministry of Natural Resources. Responsibilities for coordinating all forestry research in Ontario have now been assumed by the Ontario Forestry Research Committee, which has representatives from forest industry, universities and federal and provincial governments. This Committee also ensures that research results are transmitted to forest managers.

Staff of the forestry development program negotiate and administer federal-provincial cost-sharing agreements with the province of Ontario, conduct economic studies, and assist in implementing job creation programs in the forest sector. This requires close cooperation with the Ontario Ministry of Natural Resources and with other provincial and federal agencies concerned with the forest sector.

The Centre recognizes that forested land must be managed in the best public interest, not only for the wood production essential to our economy but also for the recreational purposes that are so important to our social well-being. These goals must be achieved in a manner that will maintain or improve the quality of the forest environment and preserve it for generations to come.

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTHWESTERN REGION OF ONTARIO 1986

(FOREST DISTRICTS: RED LAKE, SIOUX LOOKOUT, KENORA, DRYDEN, IGNACE AND FORT FRANCES)

D.C. CONSTABLE and E.J. CZERWINSKI

GREAT LAKES FORESTRY CENTRE

CANADIAN FORESTRY SERVICE

GOVERNMENT OF CANADA

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SURVEY HIGHLIGHTS

This report deals with the more important insect and disease problems in the Northwestern Region as determined from aerial and ground surveys.

In 1986, 210,104 ha of forests were sprayed against the jack pine budworm in Kenora, Dryden, Fort Frances and Red Lake districts and 168 ha against the spruce budworm in Sioux Lookout and Ignace districts.

The jack pine budworm infestation increased by approximately 76,300 ha and moved east and south of the 1985 infestation. Jack pine budworm mortality plots established in the region indicate that whole-tree mortality is now averaging 6%, and 15% of the trees have either bare or dying tops. The spruce budworm infestation also increased in area; however, increases were observed in only two districts, Sioux Lookout and Red Lake, with the largest expansion (200,300 ha) in the latter. After three successive years of severe defoliation, balsam fir mortality is now appearing in the Bending, Paddy and Dimple Lake areas of Ignace District. The fall cankerworm was observed in significant numbers only in the Sioux Lookout and Dryden districts. A decline in populations of the red pine sawfly, yellowheaded spruce sawfly and balsam fir sawfly occurred in numerous areas of the region.

Spruce needle rusts were again present throughout many areas of the region and several pockets of frost damage on trembling aspen were aerially mapped in the Kenora and Fort Frances districts.

Special surveys were conducted in 12 black spruce plantations to evaluate insect and disease problems. Black spruce cones were collected from two upland and two lowland sites to determine causal agents related to seed loss and cone damage. Three acid rain plots were examined to detect early evidence of damage. Surveys were continued to sample either dead or dying trees for the presence of the pinewood nematode.

In this report, the following categories are used to describe the importance of insects and diseases:

Major Insects or Diseases

capable of causing serious injury to or death of living trees or shrubs

Minor Insects or Diseases

capable of causing sporadic or localized injury but not usually a threat to living trees or shrubs.

Frontispiece

A continuing part of Forest Insect and Disease Survey work entails regular visits to Ontario Ministry of Natural Resources tree improvement sites to detect insect damage and disease pathogens, as in this black spruce (*Picea mariana* [Mill.] B.S.P.) plantation at Goodie Lake North in the Sioux Lookout District.

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

(1) those which are of minor importance and have not been known to cause serious damage to forest trees,

(2) those which are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage in 1985.

Note: Forest districts affected by specific insects or diseases are listed beneath the name of those insects or diseases in the Table of Contents.

The authors would like to express their appreciation to personnel of the Ontario Ministry of Natural Resources (OMNR) and wood-using industries for their cooperation during the 1986 field season.

D.C. Constable

E. Czerwinski

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INSECTS

Major Insects

Fall Cankerworm, *Alsophila pometaria* (Harr.)

After three consecutive years of severe defoliation at widely scattered locations throughout the region, population levels of this early defoliator declined. In the town of Sioux Lookout, Sioux Lookout District, only occasional trees were defoliated and damage did not exceed 30% defoliation. In the town of Dryden, Dryden District, defoliation on a few Manitoba maple (*Acer negundo* L.) trees was in the 40% range. Elsewhere in the region, defoliation was less than 10%.

No mortality of host trees has been observed in the region as a result of repeated defoliation.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Results of damage surveys, population sampling and egg-mass counts of this pest will be published with those of other regions at a later date in a report specifically devoted to this insect. The report will provide a complete description and analysis of developments in the spruce budworm situation in Ontario in 1986 and will give infestation forecasts for the province for 1987.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

An overall increase of 76,300 ha of moderate-to-severe defoliation occurred in the region (Fig. 1, Table 1). The infestation advanced east and south of that in 1985. The most noticeable increases occurred in the Dryden, Sioux Lookout and Fort Frances districts. In the Ignace District, there was a slight increase of 21,400 ha, with infestations occurring south of Hook and Mameigwess lakes and from Sandbar Lake east to Burk Township. In the Sioux Lookout District, several pockets of defoliation were mapped beyond the 13th baseline in the vicinity of Windigo Lake. A decline was evident in the Kenora and Red Lake districts; however, the bulk of the defoliation (more than 800,000 ha) persists in the Red Lake District, with the main infestation stretching from the Roderich Lake area east to Trout Lake, north to Deer Lake and west to the Manitoba border.

Although infestations in the Kenora District declined by 56,500 ha, approximately 315,000 ha recurred in scattered pockets south of Umfreville Lake and west to Keewatin and the Manitoba border, while a new pocket of infestation was mapped on the Aulneau Peninsula. In the Dryden District, severe defoliation occurred west and north of Vermilion Bay. There were several pockets of severe defoliation on the northern boundary between Lac Seul and Anishinabi Lake, and a new pocket was recorded east of Meggisi Lake. In the Fort Frances District, defoliation

NORTHWESTERN REGION

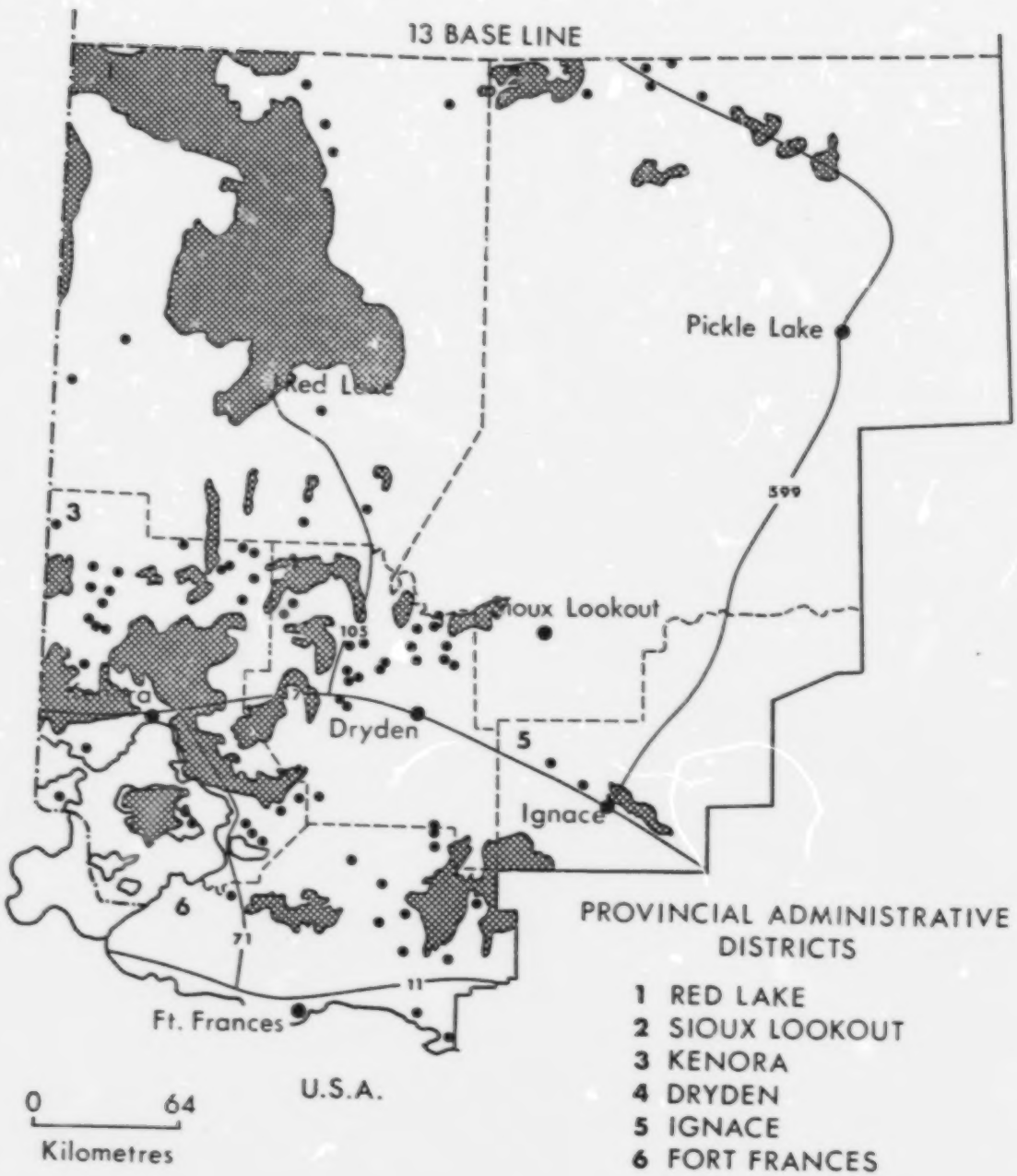

Figure 1. Jack Pine Budworm
Choristoneura pinus pinus Free.

Areas within which defoliation of jack pine (*Pinus banksiana* Lamb.) occurred in 1986

Moderate-to-severe ▩ or ●

Table 1. Gross areas (ha) of moderate-to-severe defoliation (current) by the jack pine budworm in 1985.

District	Area of moderate-to-severe defoliation	
	1985	1986
Red Lake	1,027,202	877,521
Fort Frances	44,652	99,391
Ignace	15,973	37,435
Kenora	372,242	315,731
Sioux Lookout	1,646	90,408
Dryden	16,103	133,653
TOTAL	1,477,818	1,554,139

also increased. Some of it was evident in the large infestation that encompassed the four corners of the Fort Frances, Dryden, Ignace and Atikokan districts. Damage to jack pine (*Pinus banksiana* Lamb.) regeneration throughout the region was considered light and defoliation remained less than 10%.

In an effort to minimize feeding damage on mature timber and regeneration so as to reduce the potential for expansion of the infestation, OMNR carried out an aerial spray program in the region. In all, 210,104 ha were sprayed in selected high-value areas in Dryden, Kenora, Sioux Lookout and Red Lake districts, with the bulk of the spray program being carried out in the Red Lake District. The bacterial insecticide *Bacillus thuringiensis (B.t.)* was applied in all of the areas mentioned above, and generally provided good foliage protection in the treated stands.

In 1986, several areas of whole-tree and top mortality were aerially mapped (Fig. 2). In the Kenora District, small pockets of this type of damage occurred in the Wingiskus, Eden, Sydney, Armstrong and Norway lake areas. In the Fort Frances District, top mortality was observed on the west side of Side Lake and south of Side Creek. No new areas of mortality were observed in the Red Lake District. Mortality plots established in 1985 and 1986 in the Red Lake District and one area in the Kenora District (Table 2) revealed that whole-tree mortality on 10 plots averaged 6%, while 15% of the trees had bare or dying tops.

Egg-mass samples were collected at 171 locations across the region so that population levels for 1987 could be forecasted (Table 3). As indicated by the modified infestation forecast, generally light defoliation can be expected in 1987.

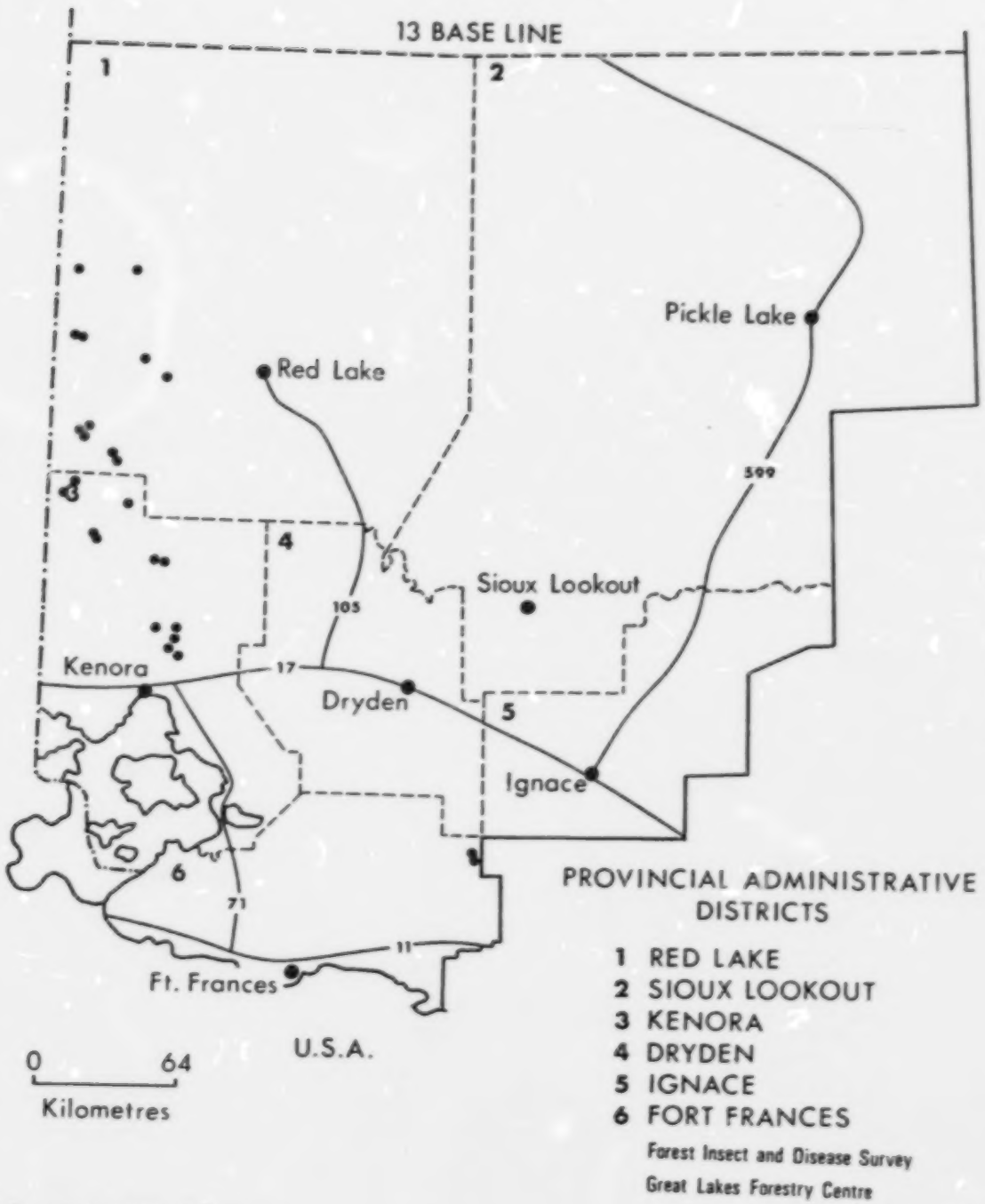

Figure 2. Jack Pine Budworm, *Choristoneura pinus pinus* Free.

Areas in which top or whole-tree mortality occurred in 1986... ●

Table 2. Summary of jack pine budworm-associated tree mortality based on examination of 100 jack pine trees at each location.

District	Location	Living		Dead		Bare tops	
		1985	1986	1985	1986	1985	1986
Red Lake	Artery Lake	82	82	3	3	15	15
	Artery Lake[a]	-	96	-	1	-	3
	Baird Twp[a]	-	71	-	12	-	17
	Carroll Lake	92	98	2	1	6	1
	Bulging Lake	78	68	7	17	15	15
	Donald Lake	88	91	8	5	4	4
	Haggart Lake[a]	-	73	-	12	-	15
	Royd Lake	64	71	3	2	33	37
	Sabourin Lake	82	89	3	10	33	1
Kenora	Norway Lake[a]	-	62	-	1	-	37

[a] Established 1986

Since the outbreak is apparently in a declining phase, the buildup of parasites and other mortality factors can lead to sudden population collapses which make infestation forecasts difficult. These factors notwithstanding, an increase in egg-mass densities in parts of Kenora, Ignace and Dryden districts indicates that recurring pockets of moderate or, in a few cases, severe defoliation are possible within previously infested areas in these districts. In addition, a few new pockets of moderate-to-severe defoliation may develop along the Dryden-Fort Frances district boundary in the vicinity of Manitou Lake.

Sawyer Beetles, *Monochamus* spp.

Aerial and ground surveys conducted in the region failed to uncover any damage caused by these sawyer beetles, especially in areas adjacent to logging operations. Members of this genus often cause heavy mortality in fire-damaged trees or trees adjacent to log piles. The insects also damage windthrown trees or timber in standing log piles.

High numbers of adults were observed in the Corallen Lake area of the Red Lake District. Adults were attracted to this area as a result of Red Lake Fire #7.

A survey of 50 fire-damaged black spruce (*Picea mariana* [Mill.] B.S.P.) and 50 fire-damaged jack pine trees with heights of 12-14 m and diameters of 7-21 cm revealed that 86% of the jack pine had larval activity but only 22% of the black spruce had been attacked.

Table 3. Northwestern Region - Jack pine budworm: Summary of defoliation estimates and egg-mass counts in 1986 and infestation forecasts for 1987 on jack pine.

Location	Estimated defoliation 1986 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1987[a]	Modified infestation forecasts for 1987[b]
Dryden District (35 locations)				
Avery Twp	9	1	L	L
Aerobus Lake - Stand 126	66	17	H	L
Breithaupt Twp	27	15	H	L
Camp Robinson	4	8	H	L
Cliff Lake - West	2	3	M	L
- North	2	1	L	L
Colenso Twp	0	0	N	N
Docker Twp	0	4	M	L
Eagle Lake - Bear Narrows	0	3	M	L
- Niven Bay Rd	6	1	L	L
Fluke Lake - West	45	7	H	L
- SW	62	16	H	L
Glider Lake	47	13	H	L
Inar Lake	38	6	H	L
Kawijikiwa Lake	2	0	N	N
Kekekwa Lake	6	15	H	L
Kennewapekko Lake	2	1	L	L
Keynote Lake	53	9	H	L
Little Clay Lake	14	10	H	L
Mutrie Twp - Impact Plot	70	37	H	L
Ord Lake	2	2	L	L
Rattlesnake Creek	2	7	H	L
Rawlinson Creek	48	11	H	L
Rawlinson Lake	30	9	H	L
Redvers Twp	6	3	M	L
Rugby Twp	0	2	L	L
Smellie Twp	62	10	H	L
Thaddeus Lake	46	2	L	L
Toole Lake	7	3	M	L
Tustin Twp - Fiesta Lake	53	8	H	L
- Winnage Lake	29	10	H	L
Vaughan Lake	10	3	M	L
Wapagessi Lake	54	15	H	L
Zealand Twp - Nursery SW	0	2	L	L
- Nursery NE	0	1	L	L

(cont'd)

Table 3. Northwestern Region - Jack pine budworm: Summary of defoliation estimates and egg-mass counts in 1986 and infestation forecasts for 1987 on jack pine (cont'd).

Location	Estimated defoliation 1986 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1987[a]	Modified infestation forecasts for 1987[b]
Fort Frances District (22 locations)				
Bearpaw Lake	5	3	M	L
Calder Lake	18	1	L	L
Claxton Twp	37	17	H	L
Doman Lake	6	1	L	L
Entwine Lake	27	1	L	L
Farrington Twp	45	2	L	L
Halkirk Twp	42	6	H	L
Heron Lake	22	2	L	L
Highrock Lake	20	16	H	L
Jones Lake	38	6	H	L
Kaiarskons Lake	24	3	M	L
Kaminni Lake	4	9	H	L
Kinnyu Lake	8	9	H	L
Konigson Lake	58	6	H	L
Little Turtle Lake Jct	44	5	M	L
Makomesut Lake	46	4	M	L
Manion Lake - seed orchard	12	1	L	L
Moosetrack Lake	4	0	N	N
Oliver Lake	54	27	H	L
Pettit Lake	6	1	L	L
Scattergood Lake	12	2	L	L
Slender Lake	13	9	H	L
Ignace District (14 locations)				
Basket Lake	2	0	N	N
Beak Lake	13	14	H	L
Bending Lake	8	0	N	N
Bradshaw Twp	31	11	H	L
Campus Lake	1	1	L	L
Cecil Lake	0	2	L	L
Dewan Twp	30	4	M	L
Ignace Twp	10	3	M	L
McNevin Twp	0	1	L	L

(cont'd)

Table 3. Northwestern Region - Jack pine budworm: Summary of defoliation estimates and egg-mass counts in 1986 and infestation forecasts for 1987 on jack pine (cont'd).

Location	Estimated defoliation 1986 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1987[a]	Modified infestation forecasts for 1987[b]
Ignace District (cont'd) (14 locations)				
Osaquan Twp	5	4	M	L
Paddy Lake	2	3	M	L
Paguchi Lake	7	0	N	N
Revell Twp	13	8	H	L
Suzanne Lake	0	1	L	L
Kenora District (33 locations)				
Barras Lake	11	14	H	L
Code Twp	14	9	H	L
Colonna Lake	19	2	L	L
Dryberry Lake	10	2	L	L
English River - Block 103	16	5	M	L
Forgotten Lake	43	2	L	L
Grassy Narrows	0	6	H	L
Haycock Twp	26	22	H	L
Helder Lake	19	5	M	L
Jackman Twp	57	7	H	L
Jaffray Twp	12	4	M	L
Kirkup Twp	19	10	H	L
Lake of the Woods - Blueberry Inlet	18	6	H	L
- Devil's Bay	6	4	M	L
MacNicol Twp	75	26	H	L
Melick Twp	54	13	H	L
Minaki	17	4	M	L
Oak Lake	5	5	M	L
Pickerel Lake Rd	9	6	H	L
Redditt Twp - Impact Plot	52	20	H	L
- Check Plot	67	15	H	L
Rice Twp	61	12	H	L
Roger Lake - Block 101	20	16	H	L
Rupert Lake	3	10	H	L
Sand Lake	5	6	H	L

(cont'd)

Table 3. Northwestern Region - Jack pine budworm: Summary of defoliation estimates and egg-mass counts in 1986 and infestation forecasts for 1987 on jack pine (cont'd).

Location	Estimated defoliation 1986 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1987[a]	Modified infestation forecasts for 1987[b]
Kenora District (cont'd) (33 locations)				
Sydney Lake - Block 77	7	1	L	L
Umback Twp	10	1	L	L
Umfreville Lake - East	12	0	N	N
- Centre	36	7	H	L
- West	6	5	M	L
Werner Lake	6	7	H	L
White Dog	18	5	M	L
Wonderland Lake	44	3	M	L
Red Lake District (51 locations)				
Arrowhead Lake	0	2	L	L
Baird Twp - 3 km Suffel L. Rd	16	3	M	L
- 6 km Suffel L. Rd	2	2	L	L
- Block 13	0	4	M	L
Ball Twp	2	5	M	L
Bateman Twp	21	6	H	L
Beauregard Lake	2	0	N	N
Bigshell Lake	9	6	H	L
Bluffy Lake	0	0	N	N
Bruce Lake	0	0	N	N
Bunny Lake	3	2	L	L
Camping lake	0	1	L	L
Carroll Lake	0	4	M	L
Coli Lake	0	3	M	L
Corallen Lake	17	0	N	N
Dixie Lake	0	0	N	N
Dixie River	1	1	L	L
Earngey Twp	2	0	N	N
Emarton Lake	52	8	H	L
Fatty Lake	0	15	H	L
Flunder Lake	0	0	N	N
Gammon Lake	4	0	N	N

(cont'd)

Table 3. Northwestern Region - Jack pine budworm: Summary of defoliation estimates and egg-mass counts in 1986 and infestation forecasts for 1987 on jack pine (cont'd).

Location	Estimated defoliation 1986 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1987[a]	Modified infestation forecasts for 1987[b]
Red Lake District (cont'd) (51 locations)				
Haggart Lake	0	10	H	L
Hanton Lake	0	1	L	L
Heyson Twp	39	4	M	L
Killala Twp - Block 14	6	5	M	L
Kirkness Lake	15	18	H	L
Knott Twp	6	4	M	L
Little Vermilion Lake - SE	18	6	H	L
Little Vermilion Lake - SW	0	8	H	L
Longlegged Lake	0	4	M	L
Longlegged Lake - Block 42	7	2	L	L
Longlegged River	2	1	L	L
Musklow Lake	2	1	L	L
Nungesser Creek	2	8	H	L
Offer Lake	2	1	L	L
Pakwash Lake	30	4	M	L
Pineneedle Lake	3	4	M	L
Pineneedle Lake - Block 39	0	4	M	L
Primok Lake	10	1	L	L
Prospect Lake - Block 47	0	3	M	L
Red Lake - East Bay	2	14	H	L
Sabourin lake	3	4	M	L
Skinner Twp	0	6	H	L
Snakeweed Lake	0	0	N	N
Sobel lake	0	0	N	N
Trout lake	5	1	L	L
Unexpected Lake	3	3	M	L
Valhalla Lake	13	4	M	L
Wagin Lake	3	9	H	L
Wenasaga Lake	12	5	M	L
Sioux Lookout District (16 locations)				
Gallivan Lake	0	3	M	L
Goodie Lake - Impact Plot	18	5	M	L

(cont'd)

Table 3. Northwestern Region - Jack pine budworm: Summary of defoliation estimates and egg-mass counts in 1986 and infestation forecasts for 1987 on jack pine (concl.).

Location	Estimated defoliation 1986 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1987[a]	Modified infestation forecasts for 1987[b]
Sioux Lookout District (cont'd)				
- Spray Block	1	1	L	L
- Check Plot	27	2	L	L
Hudson	0	3	M	L
Lac Seul - Canoe Bay	0	1	L	L
- Coone Bay	0	2	L	L
Lynx Paw Lake	2	0	N	N
Madaire Lake	0	2	L	L
McCoy Lake	0	0	N	N
Moose Lake Rd	0	1	L	L
Niemi Lake	0	1	L	L
Purmal Lake	0	2	L	L
Stirland Lake	0	0	N	N
Lynx Paw Lake	2	0	N	N
Madaire Lake	0	2	L	L
McCoy Lake	0	0	N	N
Moose Lake Rd	0	1	L	L
Niemi Lake	0	1	L	L
Purmal Lake	0	2	L	L
Stirland Lake	0	0	N	N
Sunlight Lake	0	1	L	L
Vermilion River Rd	0	0	N	N

[a] N = nil, L = light, M = moderate, H = heavy

[b] Modified infestation forecasts: During the last major jack pine outbreak in Ontario, the following standard jack pine defoliation forecast was developed:

Total egg masses on six 60-cm tips (Year X)	Defoliation forecast (Year X + 1)	Defoliation (Year X + 1) (%)
0	0	0
1-2	light (L)	1-25
3-5	moderate (M)	26-75
6+	severe (S)	76+

This relationship was found to be reliable during the first year or two of the current jack pine budworm outbreak, but in older infestations (3-4 years) it generally overestimated the defoliation potential. The "modified infestation forecast" presented in these tables is based on analysis of egg-mass counts and subsequent defoliation in 1984, 1985 and 1986 from northwestern and northeastern Ontario. The reasons for modifying the forecast are related to an increase in parasitism rates and a reduction in the production of male flowers.

Balsam Fir Sawfly, *Neodiprion abietis* complex

Although there was an overall population decline in the region, moderate-to-severe defoliation persisted on scattered stands of balsam fir (*Abies balsamea* [L.] Mill.) within an area of approximately 11,000 ha in the Ear Falls-Pakwash Lake area, Red Lake District (Fig. 3). Defoliation ranged from 10% to 75% on trees mainly in the 5 to 8 m height class; however, damage to black spruce and white spruce (*Picea glauca* [Moench] Voss) was less than 10%. In the Winston Lake area of the Sioux Lookout District, a small pocket of balsam fir approximately 2 ha in size sustained 20% defoliation. Infestations declined to light intensity on balsam fir in areas north and south of Kenora, Kenora District, in Smellie and Van Horne townships, Dryden District, and in Claxton Township, Fort Frances District. Light damage was also observed on single trees and small clumps of trees at several areas in the Ignace District.

General observations revealed that damage was confined mainly to balsam fir throughout the region, and there was very little defoliation on white and black spruce. (This was not the case in previous years.)

Red Pine Sawfly, *Neodiprion nanulus nanulus* Schedl.

In 1983 and 1984, moderate-to-severe defoliation by this sawfly was observed at numerous locations in the region. The most significant damage occurred in the Corman, McNevin and Cathcart townships of Ignace District, with defoliation ranging from 75% to 100%. However, in 1985 defoliation in these same areas declined to about 20% and in 1986 only single colonies were observed with trace amounts of defoliation present. In 1985 in the Dryden District, approximately 8,700 ha of jack pine and red pine (*Pinus resinosa* Ait.) in parts of Smellie and Wabigoon townships suffered defoliation of 75% to 100%, but defoliation declined to trace levels this past year.

Elsewhere in the region only single colonies were occasionally observed during routine surveys.

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Roh.)

For at least 10 years, high populations of this sawfly have persisted in the region, especially in the Fort Frances District. Ornamental spruces (*Picea* spp.) within the town of Fort Frances have been heavily attacked and there has been severe defoliation of white spruce trees at Caliper Lake Provincial Park and on windbreaks along Highway 71 near the village of Finland. In 1986, however, numbers were low in the abovementioned areas. In only two areas in the region was there noticeable defoliation of spruce trees in the 1- to 2-m height class: along Highway 596, north of Kenora in Pellott Township, Kenora District and at

NORTHWESTERN REGION

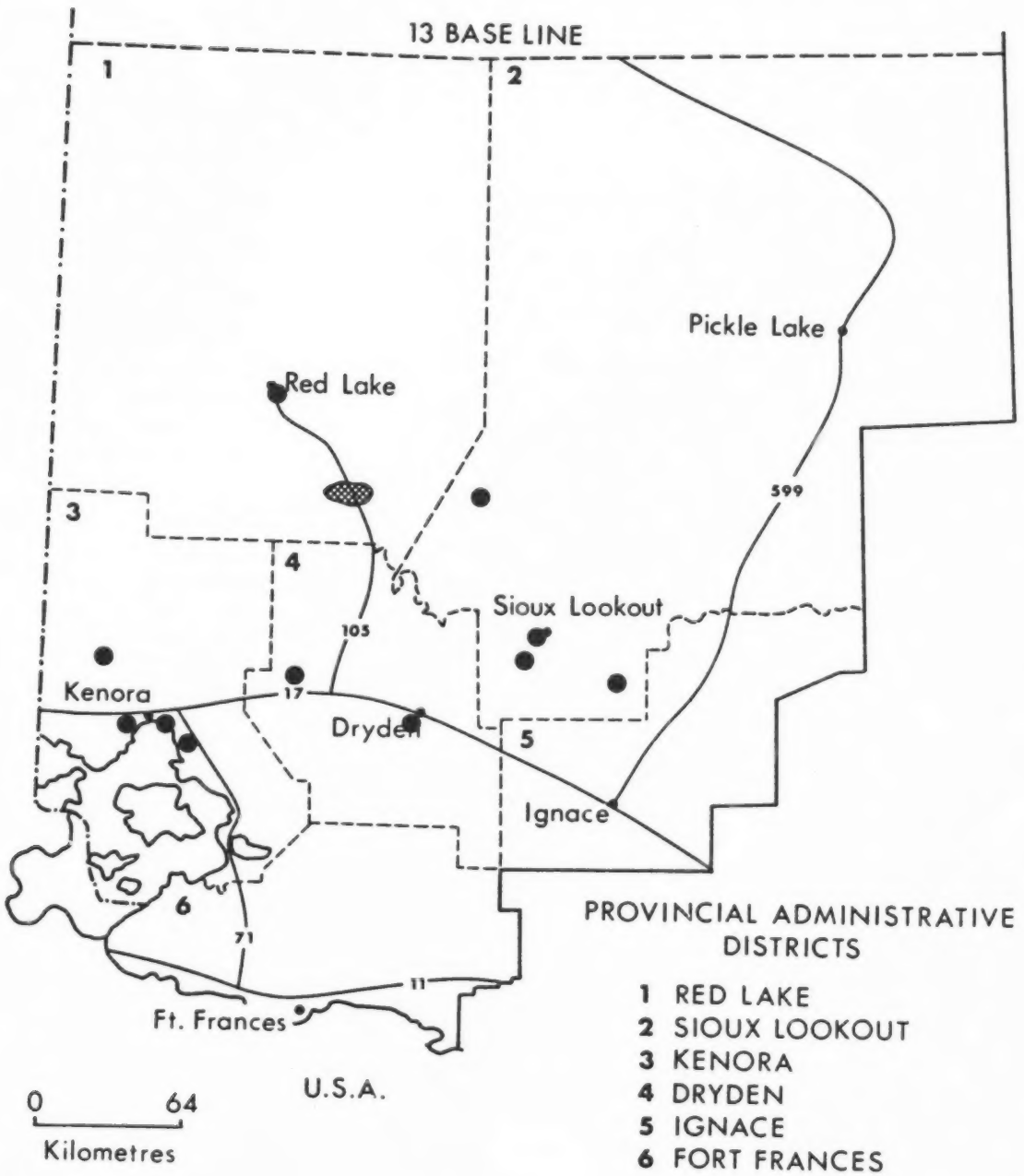

Figure 3. Balsam Fir Sawfly, *Neodiprion abietis* complex

Areas within which defoliation occurred in 1986

Moderate-to-severe.....

Light.....

Caliper Lake Provincial Park, Fort Frances District. Trees in the former area were 40-70% defoliated, and individual trees in the latter area were 10-20% defoliated.

For unknown reasons, population levels collapsed and this insect was difficult to detect after having caused moderate-to-severe damage for many years. Throughout most of the region only single colonies were found, and defoliation was negligible.

White Pine Weevil, *Pissodes strobi* (Peck)

As in the past, this insect continued to damage leaders in the 2- to 3-m height class (Table 4). At one location near Big Sawbill Lake, Fort Frances District, 17.3% of the 1986 shoots were destroyed and at 37 km along the Snake Bay Road, Dryden District 15.3% of the shoots were destroyed. For the second year, damage was also observed in several of the black spruce tree improvement sites (Table 9). However, as in the past, infested shoots were hand clipped and destroyed by OMNR.

Minor Insects

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)

Population levels of this defoliator increased throughout the region.

Defoliation of American mountain-ash (*Sorbus americana* Marsh.) varied widely throughout the working area. The most noticeable area of damage occurred for a distance of approximately 20 km along Highway 105 north of Ear Falls in the Red Lake District. Roadside trees in this area suffered defoliation ranging from 25 to 100%. As in 1985, numerous colonies were observed along Highway 71 from Kenora to Fort Frances and at many points along Highway 596 north to Minaki.

European mountain-ash (*S. aucuparia* L.) and showy mountain-ash (*S. decora* [Sarg.] Schneid.) ornamentals in the towns of Sioux Lookout, Dryden, Kenora and Fort Frances suffered defoliation between 75% and 100%. Defoliation in the town of Ignace, Ignace District was less than 20%.

Table 4. Summary of damage to jack pine by the white pine weevil in the Northwestern Region in 1986.

Location	Estimated area affected (ha)	Estimated no. of trees per (ha)	Avg ht of trees (m)	Leaders attacked (%)
Dryden District				
Snake Bay Road 42 km	100	4,000	2.8	2.0
Snake Bay Road 37 km	10	3,200	1.5	15.3
Fort Frances District				
Big Sawbill Lake	100	8,000	3.1	17.3
Manion Lake Road	5	1,000	0.9	12.0
Turtle River Road	25	3,200	2.5	7.3
Ignace District				
Furniss Lake Road	876	7,500	2.1	8.6
Kenora District				
MacNicol Twp	500	8,500	0.8	0.0
McMeekin Twp	25	2,990	2.2	2.6
Red Lake District				
McKenzie Bay Road	500	5,000	3.0	5.3
Dixie Lake Road	500	5,000	1.5	2.7
Sioux Lookout District				
Barrett Twp	1,000	7,000	2.0	4.0
Island Lake	130	1,200	2.3	5.3
Vermilion River Road	20	2,500	2.3	4.0

Table 5. Other forest insects

Insect	Host(s)	Remarks
Acleris variana (Fern.) Eastern blackheaded budworm	wS, bS	commonly found in low numbers across the region
Acrobasis betulella Hlst. Birch tubemaker	wB	causing 2.0% defoliation in a 5-ha stand near Kawawia Creek, Fort Frances District
Actebia fennica (Tausch.) Black army cutworm	general feeder	light damage observed in seedbeds at the Dryden Forest Station
Macrohaltica ambiens Harr. Alder flea beetle	Al	causing upwards of 100% skeletonizing of foliage throughout Halkirk Twp, Fort Frances District and at scattered locations along the Marchington Road, Sioux Lookout District
Aphrophora cribrata (Walker) Pine spittlebug	ScP	causing twig and branch mortality in a 1-ha stand of Scots pine (*Pinus sylvestris* L.) trees 2 m in height in Southworth Twp, Dryden District
Archips cerasivorana (Fitch) Uglynest caterpillar	pCh, cCh	trace levels observed on roadside shrubs in Southworth Twp, Dryden District and in the Wildland Reserve, Fort Frances District
Bucculatrix canadensisella Cham. Birch skeletonizer	wB	trace levels observed throughout the region
Chionaspis pinifoliae (Fitch) Pine needle scale	wS, rP, jP	High populations have persisted for the third year on scattered clumps of trees at Abram Lake, Sioux Lookout District.
Cinara spp.	bS	14.6% of trees infested at Beauregard Seed Orchard, Red Lake District
Dioryctria zimmermani (Grt.) Zimmerman pine moth	wP	causing top mortality on natural regeneration along Hwy 599 in Ignace Twp, Ignace District
Diprion similis (Htg.) Introduced pine sawfly	wP	trace levels observed in the Lake of the Woods area, Kenora District

(cont'd)

Table 5. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Eriocampa ovata (L.) Woolly alder sawfly	Al	severe defoliation observed at several locations in the region
Fenusa pusilla (Lep.) Birch leafminer	wB	Leafmining of ornamental plantings occurred at several locations throughout the region; however, defoliation did not exceed 50%.
Hyphantria cunea (Dru.) Fall webworm	deciduous	Defoliation ranged from 10% to 25% on roadside trees on Hwy 596 south of Minaki, Kenora District, and along Hwy 502 in the Fort Frances District.
Malacosoma californicum pluviale Dyar Northern tent caterpillar	pCh	scattered colonies observed at several points along the Marchington Road, Sioux Lookout District and Hwy 502, Dryden District
Mayetiola piceae (Felt) Spruce gall midge	bF	75% of buds damaged at one location, in Drayton Twp, Sioux Lookout District
Neodiprion swainei Midd. Swaine jack pine sawfly	jP	trace numbers found on semimature trees at Rupert Lake, Kenora District
Neodiprion virginianus complex Redheaded jack pine sawfly	jP	Defoliation remained less than 10% throughout the region.
Nymphalis antiopa (L.) Mourningcloak butterfly	deciduous	isolated colonies observed at Ojibway Provincial Park and in the Hudson area, Sioux Lookout District
Petrova albicapitana (Busck.) Northern pitch twig moth	jP	trace populations observed in the region
Phratora purpurea purpurea Brown Aspen skeletonizer	tA	trace levels of defoliation at several locations in the region
Phyllonorycter ontario (Free.) Aspen leafblotch miner	tA	causing 50-75% foliar damage throughout Sioux Lookout, Red Lake and Ignace districts
Phyllonorycter nipigon (Free.) Balsam poplar leafblotch miner	bPo	trace populations observed in the region

(cont'd)

Table 5. Other forest insects (concl.).

Insect	Host(s)	Remarks
Pristiphora erichsonii (Htg.)	tL	occasional colonies observed on host trees throughout the region
Pyrrhalta decora decora (Say) Gray willow leaf beetle	W	causing upwards of 100% browning of foliage throughout the region
Trypodendron lineatum (Oliv.) Striped ambrosia beetle	tL	high populations present in a 1-ha stand of trees, Stanzhikimi Lake area, Sioux Lookout District
Vasates quadripedes (Shimer) Maple bladdergall mite	siM	causing 100% foliar damage on ornamental plantings, Ilsley Twp, Ignace District

Damage caused by Hypoxylon canker, *Hypoxylon mammatum* (Wahlenb.) J. Miller, to trembling aspen (*Populus tremuloides* Michx.)

Analysis of foliage from ARNEWS plots

TREE DISEASES

Major Diseases

Spruce Needle Rusts, *Chrysomyxa ledi* (Alb. and Schwein.) de Bary var. *ledi* and *C. ledicola* (Peck) Lagerh.

Varying levels of infection caused by these foliar rusts on black spruce were present across the region in 1986.

The highest level of infection occurred in black spruce stands approximately 20 ha in size in Corman, Dewan, Ignace and Skey townships, Ignace District. Host trees ranging in size from 1 to 4 m were most commonly affected and foliar damage averaged 75%.

Damage was also prevalent along Hwy 599 north of the town of Savant Lake. Throughout Conant and McCubbin townships, Sioux Lookout District, the incidence level was 100%; however, only 5% foliar damage occurred.

Foliar damage this year remained less than 25% in the Coli Lake area north of Red Lake, where severe damage occurred in 1986 throughout a 255,000 ha area in Red Lake District.

In the remainder of the region, light-to-moderate damage occurred in some treed muskegs and stands less than 5 ha in size. Foliar damage remained less than 40% where 75% of the trees were infected. Trace levels of infection could be found in just about any black spruce stand.

Tar Spot Needle Cast, *Davisomycella ampla* (J. Davis) Darker

This disease, which is capable of causing severe defoliation of 1-year-old needles of jack pine, was present in three areas of the region; foliar damage levels were low. In the Crystal River area of Ignace District, the incidence of the disease was 100%, and approximately 500 ha of trees 1.7 m high suffered 15% foliar damage. In Lomond Township, Sioux Lookout District, 77% of 1.6-m-high trees had an average of 20% foliar damage, while in McMeekin Township, Kenora District, only 1% of trees 1 m high in a 25-ha stand had 10% of the foliage damaged.

Elsewhere in the region, this pathogen was rarely encountered and, when found, was only at trace levels.

Western Gall rust, *Endocronartium harknessii* (J.P. Moore) Y. Hirats.

For at least the past 20 years, infection by this gall rust has seriously affected jack pine trees across the region, especially regeneration. In 1966, surveys revealed that 52% of jack pine trees growing in the Abitibi License area, Block 10, Sioux Lookout District were

affected, and the average for that year was 29%. In 1971, special surveys conducted in the region revealed that branch and stem damage ranged from 5% in the Ignace District to 82% at Williamson Lake, Fort Frances District, and 10% mortality occurred on 1-m-high regeneration along the Turtle Tank Road, Fort Frances District. In 1976, 10 to 15% of the 2-0 jack pine transplant stock lifted for outplanting at the Dryden Forest Station was found to be infected. Again in 1979, special surveys revealed that the number of galls ranged from 1% to 43% and in similar surveys repeated in 1982, 15% of the trees were infected. From 1983 to 1985 the incidence rate averaged 13%. However, in 1986 a slight decline was evident and from 1.3% to 8.7% of the trees were affected by galls (Table 6).

A control program was carried out at the Dryden Forest Station in 1986. A fungicide was applied to all jack pine stock within the nursery. Spraying began as soon as the gall-bearing pines began to produce orange-colored aeciospores. The timing of sporulation was monitored by Forest Insect and Disease Survey (FIDS) staff.

Hypoxylon Canker, *Hypoxylon mammatum* (Wahlenb.) J. Miller

This year, four study plots that were established in 1984 were reevaluated for the presence and abundance of hypoxylon cankers (see photo page). In this study, branch cankers, stem cankers and current mortality were to be recorded. Two trembling aspen (*Populus tremuloides* Michx.) stands in Sioux Lookout District and two in Fort Frances District revealed little change in status since 1984. Damage in 1986 ranged from 0.7% to 5.3% on the stems affected in comparison with 0.7% to 4.6% in 1984. Current mortality was 0.7% in both study years (Table 7).

Table 6. Summary of damage caused by western gall rust in the Northwestern Region in 1986 (counts based on examination of 150 randomly selected jack pine trees at each location).

Location	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Trees affected (%)	Trees severely[a] damaged (%)
Dryden District					
Snake Bay Road	100	4,000	2.8	5.3	5.3
Fort Frances District					
Turtle Lake Road	200	3,000	1.0	6.0	0.0
Bear Paw Road	200	2,400	0.9	1.3	1.3
Ignace District					
Crystal River	500	8,000	1.8	6.0	2.7
Kenora District					
McMeekin Township	75	1,800	1.2	2.0	0.0
Red Lake District					
McKenzie Bay Road	8	3,900	1.7	4.0	0.7
Sioux Lookout District					
McAree Twp	5	1,600	7.0	8.7	0.7
Lomond Twp	200	1,200	1.6	7.3	2.0

[a] Main stem

Table 7. Summary of damage caused by Hypoxylon canker of aspen in four study plots in the Northwestern Region in 1984 and 1986 (counts based on 150 randomly selected trees at each location).

Location	Avg DBH of trees (cm)	Basal area (m^2/ha)	Estimated stand area (ha)	Trees diseased (%)				Current mortality %	
				Branches		Stems			
				1984	1986	1984	1986	1984	1986
Sioux Lookout District									
Lewis Lake	24	28	50	0	0	0.7	2.0	0.7	0.7
Hamilton Lake	26	32	150	0	0	0.7	0.7	0	0
Fort Frances District									
Otter Falls	21	24	20	0	0.7	2.7	2.7	0	0.7
Menary Twp	22	21	40	0.7	0	4.6	5.3	0	0.7

Table 8. Other forest diseases.

Organism	Host(s)	Remarks
Armillaria mellea (Vahl:Fr.) Kummer Armillaria root rot	jP, bS	single-tree mortality observed at numerous locations across the region
Ciborinia whetzelii (Seaver) Seaver Ink spot of aspen	tA	Foliar damage remained less than 20% in Sioux Lookout District on host trees and less than 5% in Miscampbell Twp, Fort Frances District and Mutrie Twp, Dryden District.
Coleosporium asterum (Dietel) Pine needle rust	jP	less than 2% foliar damage across the region
Cronartium coleosporioides Arthur f.sp. *coleosporioides* Orange stalactiform blister rust	jP	A trace level of infection occurred in Tustin Twp, Dryden District.
Cronartium commandrae Peck Commandrum rust	jP	0.3% of the trees infected in a 20-ha plantation in MacNicol Twp, Kenora District and trace damage to lower branches in Aubrey Twp, Dryden District

(cont'd)

Table 8. Other forest diseases (concl.)

Organism	Host(s)	Remarks
Cronartium comptoniae Arthur Sweet fern blister rust	jP	trace damage to regeneration near Vermilion River, Sioux Lookout District and in Mafeking Twp, Dryden District
Cronartium ribicola J.C. Fischer White pine blister rust	wP	5.7% incidence on trees 3 m high at Ojibway Prov. Park, Sioux Lookout District
Erwinia amylovora (Burr.) Winslow *et al.* Fireblight	Mo	single-tree mortality as a result of this organism in Sandbar Prov. Park, Ignace District
Sirococcus conigenus (DC.) P. Cannon & Minter Shoot blight	rP	low incidence of infection on scattered red pine regeneration in Jordan and Echo townships, Sioux Lookout District
Valsa friesii (Duby) Fuckel Dieback	bF	found on dead branches of host trees in the Winston Lake area of Sioux Lookout District
Venturia macularis (Fr.) E. Muller & v. Arx Shoot blight	tA	sporadic damage to regeneration in Mutrie Twp, Dryden District and Godson Twp, Kenora District

ABIOTIC DAMAGE

Frost Damage

Frost damage was observed more commonly in the region this year than in 1985. Damage to trembling aspen was aerially mapped in Godson Township, Kenora District, and at the junctions of Cedar Narrows Road and Highway 502 of the Fort Frances District. Approximately 100 ha were affected in each area and up to 100% of the foliage was damaged. Evaluations conducted in black spruce plantations (Table 9) also indicated that there was damage to the current year's shoots. In one area in Mutrie Township, Dryden District, 67% shoot damage occurred on black spruce. Damage was also observed on white spruce in several areas; however, it was less than 10%.

SPECIAL SURVEYS

Gypsy Moth, *Lymantria dispar* (L.)

In a continuing national effort to detect and monitor the spread of gypsy moth, pheromone traps were again deployed in 1986 in strategic locations across the Northwestern Region (Fig. 4).

All trap locations were in provincial parks except for the Minaki Lodge site in Kenora District. Male moths were lured to the trap site by a sex attractant contained within the trap. Once there, they were retained by a sticky substance lining the inside of the trap. Across the region, two traps were deployed at each of 10 locations. All traps yielded negative results.

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

Two races of the fungus are known in North America. The North American race attacks young trees but does little damage to trees taller than 2 m. The European race can kill trees in all height classes.

As in the past, surveys were carried out across the region for the detection of both races. In 1985 and again in 1986, all areas of previously known infections caused by the North American race were visited to confirm that only the North American race was present and not the more virulent European race. Only one area (the Ozhuskans Rapids area of the Sioux Lookout District) was positively identified as having the North American race.

A random check of 200 natural regeneration jack pine trees in the 1-m class indicated 6% infection. Numerous other areas were visited during routine surveys to ensure that neither of these races was present; however, in all areas examined, no signs or symptoms of either disease were observed. The two races are compared on page 27.

Table 9. Summary of insects, disease pathogens and abiotic damage found in a special survey of black spruce stands in the Northwestern Region in 1986 (counts based on the examination of 150 trees at each location).

Location	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	White pine weevil	Spruce bud midge	Spruce budworm	Frost	Spruce needle rust
				Leaders damaged (%)	Trees damaged (%)	Trees affected (%)	Trees affected (%)	Trees affected (%)
Red Lake District								
Dixie Lake Road	10.0	1,100	6.6	0.0	24.0	37.0	22.0	0.0
Beauregard Lake+	5.0	3,200	0.9	0.0	24.0	59.0	18.7	32.6
Sioux Lookout District								
Lomond	0.8	3,100	1.9	1.3	14.7	12.7	10.7	0.0
McAree	14.5	3,000	6.8	0.7	0.0	100.0	0.0	100.0
Vermilion River Road	20.0	2,500	2.1	0.0	18.0	99.3	0.0	100.0
Dryden District								
Mutrie	25.0	1,500	3.2	0.0	0.0	78.0	67.3	0.0
Rugby	10.0	1,000	2.8	2.7	0.0	0.0	6.0	0.0
Sanford	20.0	1,200	2.6	0.0	0.0	70.7	19.3	0.0
Fort Frances District								
Kawawia Creek[a]	17.0	2,990	0.7	0.0	0.0	6.0	0.0	0.0
Manion Lake[a]	25.0	700	0.9	1.3	0.0	26.0	56.0	0.0
Marson[a]	10.0	2,990	0.7	2.0	0.0	0.0	0.0	0.0
Ignace District								
Furniss[a]	5.0	3,200	0.9	0.0	4.0	52.0	99 .3	100.00

[a] seed orchards or progeny test sites, OMNR

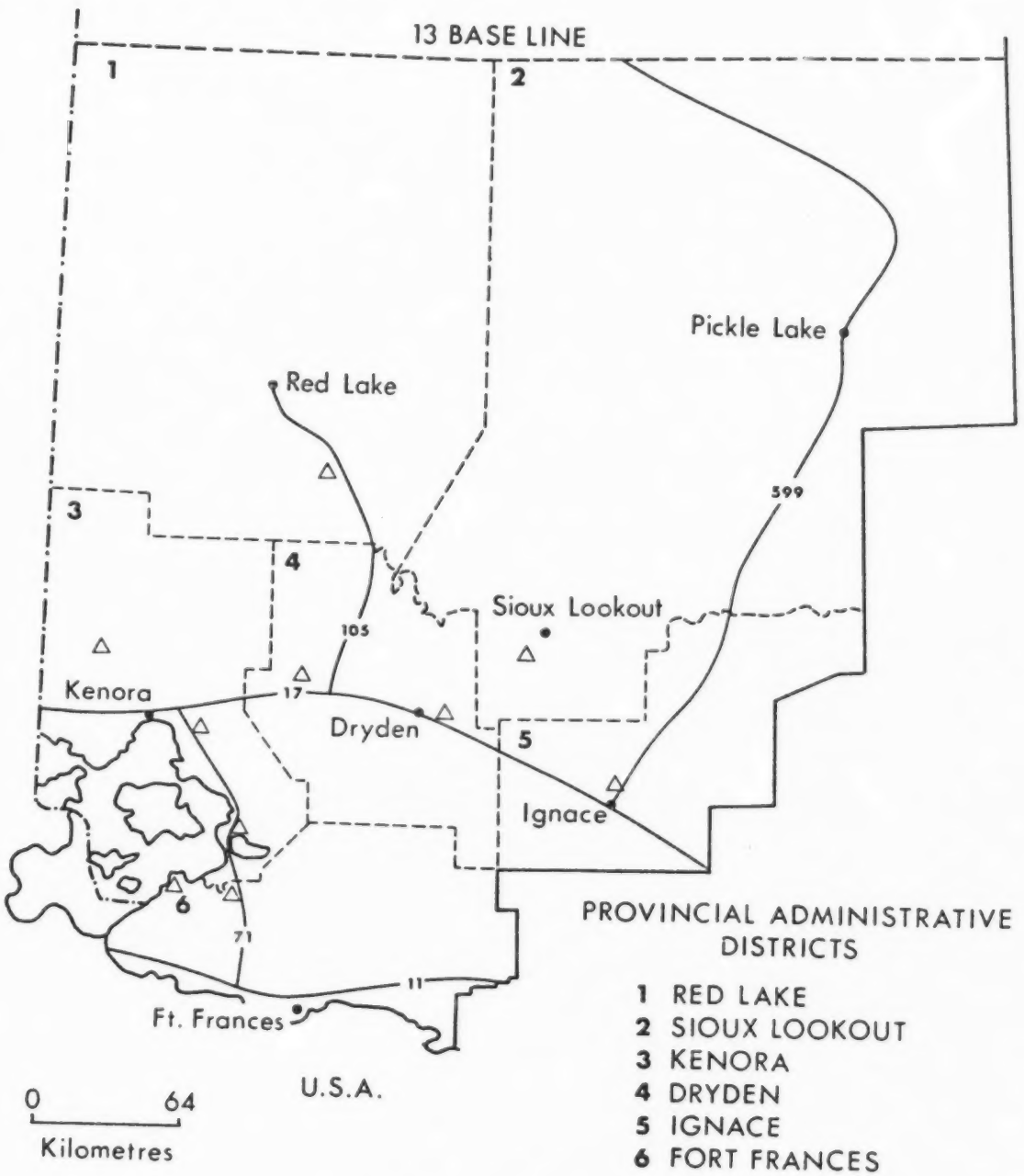

Figure 4. Gypsy Moth, *Lymantria* (L.)

Areas in which pheromone traps were deployed in 1986

Negative results.....△

European Race	North American Race
1. Needle bases turn red or yellow in May or June.	1. Same
2. All needles or infected branches turn brown in summer.	2. Same
3. Entire branches may be killed in a single year.	3. One internode is killed per year, from the tip toward the main stem.
4. The tree dies when all or most of the crown has been killed.	4. The fungus grows along a branch to the main stem, which is girdled or cankered. Massive shoot mortality results in the death of only small trees.
5. A bright green stain may occur just beneath bark on killed stems.	5. Same
6. Infected branches are found	6. Infection seldom occurs more than 2 m above ground.
7. Mature trees are killed in 2 to 4 years.	7. Damage is confined to the lower crown of mature trees.
8. Trees do not exhibit basal cankers.	8. Trees may bear basal mainstem cankers up to 2 m long.
9. Caplike fruiting structures are rare.	9. Caplike fruiting structures are abundant.
10. Pine, spruce, larch (*Larix* spp.) and Douglas fir *Pseudotsuga menziesii* [Mirb.] Franco) are affected.	10. Pine and possibly spruce are affected.

* Information provided by H.L. Gross and C.E. Dorworth

High-value Black Spruce Plantation Survey

For the third time surveys were carried out in black spruce stands in the Northwestern Region. Surveys of black spruce to determine the prevalence of specific insect and disease pests were conducted in 1980, 1983 and 1986. In all, 12 stands were examined from 17 to 26 June and from 23 July to 4 August. The insects and diseases selected and evaluated were as follows:

Insects: spruce budworm, spruce coneworm, *Dioryctria reniculelloides* Mut. & Mun., bark beetles, *Monochamus* spp. (adult feeding), yellowheaded spruce sawfly and white pine weevil.

Diseases: armillaria root rot, *Armillaria mellea* (Vahl:Fr.) Kummer, spruce needle rust, mistletoe, *Arceuthobium* spp.

Frost damage was also evaluated.

Positive results are summarized in Table 9.

Negative results were obtained for the spruce coneworm, yellowheaded spruce sawfly, bark beetle feeding, armillaria root rot and the mistletoe.

Black Spruce Seed and Cone Pests

As in 1983, a special survey was conducted at two upland and two lowland black spruce sites in the region to determine the insects that were damaging cones and causing seed loss. The two upland sites were seed production areas and the two lowland sites were representative of lowland black spruce stands across the region. At each location, 1-year-old cones were collected from a minimum of three trees from branches that represented the entire flowering portion of the crowns. The samples were collected late in July.

Table 10 summarizes the results of this survey.

Tree Improvement Sites

Once again surveys were carried out in black spruce seedling orchards across the region to monitor any major insect or disease problems that could cause significant damage.

Table 10. Summary of black spruce seed and cone damage at four locations in the Northwestern Region in 1986.

Location	No. of cones examined	Damaged cones (%)	Seed loss within damaged cones (%)	Responsible agents (in order of importance)	
Red Lake District					
8 km along Dixie Lk Rd	100	2	0.0	*Eucosma tocullionana*	1.0%
				Lepidoptera	1.0%
Sioux Lookout District					
McAree Twp[a]	100	36	57.0	*Lasiomma anthracina*	8.8%
				Lepidoptera	7.4%
				Unknown	3.9%
				Dasineura rachiphaga	0.2%
Dryden District					
Satterly Twp	100	41	38.1	Lepidoptera	11.5%
				Unknown	3.1%
				Lasiomma anthracina	1.0%
				Megastigmus atedius	0.46
Fort Frances District					
Moose Lake Area	100	12	33.8	*Lasiomma anthracina*	3.7%
				Lepidoptera	1.5%
				Megastigmus atedius	0.2%

[a] seed production area, OMNR

As in the past, the most common insect observed was the spruce budworm. In the areas evaluated for spruce budworm, the highest percentage of trees was attacked in the Beauregard black spruce seedling orchard of the Red Lake District. There, 59% of the trees were affected; however, only trace amounts of defoliation were detected. The spruce bud midge, *Rhabdophaga swainei* Felt, was also encountered in this seedling orchard, and 24% of the trees were infested in 1986. The white pine weevil was also present in several orchards; however, leader damage did not exceed 2%. In several districts of the region, a chemical control agent was applied in the spring as soon as the adult weevils appeared. As well, hand clipping of infested leaders was employed in mid-July as a means of control.

The spruce needle rusts were again observed in several of the orchards. At the Veermersch black spruce seedling orchard in Ignace District and the Goodie Lake (north and south) black spruce seedling orchards in Sioux Lookout District the incidence was 100%; however, foliar damage was in the 1% range. Armillaria root rot was detected for the first time at the Veermersch seedling orchard. Damage was sporadic and only the occasional tree was affected. Frost damage was detected at three orchards (Table 9). Foliar damage ranged from 19% to 56%.

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

In a continuing effort to detect the pinewood nematode, an additional 26 samples were submitted from the Northwestern Region in 1986 to bring the total for the past two years to 50 samples (see Fig. 5).

Most of the samples were obtained from recently dead and dying chlorotic fir, spruce or pine. These trees were sampled by removing three discs from specific areas of each stem. In addition, *Monochamus* spp. adults were collected from three locations across the region.

Adult *Monochamus* beetles transmit *Bursaphelenchus xylophilus* when this nematode begins maturation feeding on the phloem of young pine shoots. The nematode then enters the tree through the feeding wounds and reproduces rapidly in the resin canals of the host. Within four or five weeks, wilting and yellowing of foliage become noticeable and mortality is pending.

Positive samples were collected from 13 locations in 1985 (Table 11) and 11 locations in 1986 (Table 12). Negative results were obtained from samples procured at 7 and 12 locations, respectively, in 1985 and 1986.

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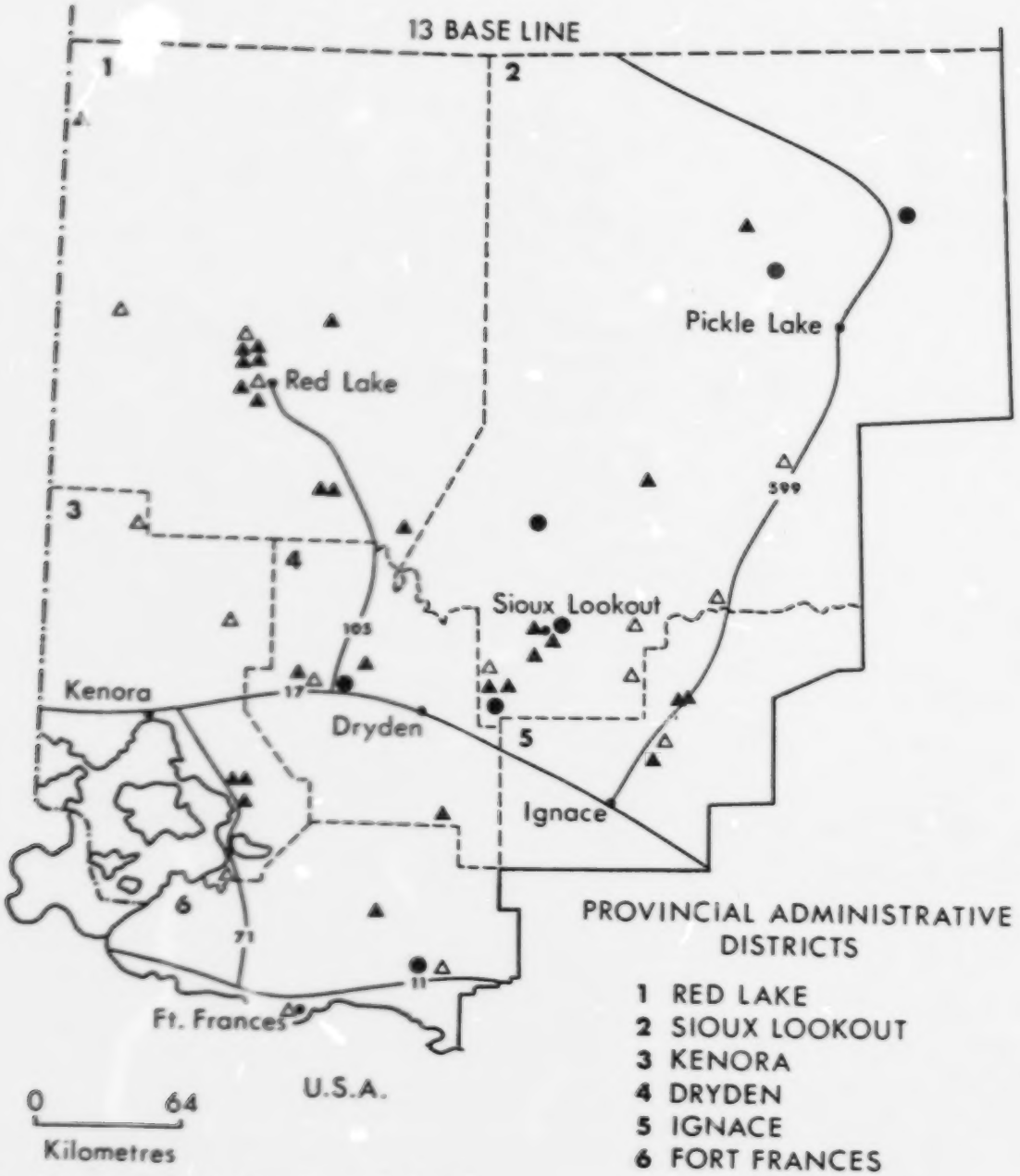

Figure 5. Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

Nematode sample points in 1985 and 1986

Positive results.....▲
Negative results.....△
Results not confirmed.....●

Table 11. Summary of locations sampled for the presence of the pinewood nematode in the Northwestern Region in 1985.

Location	Tree species[a]	Final identification
Red Lake District		
Coli Lake	bF	positive
Heyson Twp	jP	not confirmed
Heyson Twp	bF	not confirmed
Heyson Twp	jP	not confirmed
Heyson Twp	bF	positive
Heyson Twp	jP	positive
Sabourin Lake	jP	negative
Sioux Lookout District		
Drayton Twp	wP	positive
Drayton Twp	ScP	positive
Echo Twp	bF	negative
Jordan Twp	bF	positive
Lomond Twp	jP	negative
McAree Twp	jP	not confirmed
Pickerel Twp	bF	positive
Kenora District		
Devonshire Twp	bF	positive
Work Twp	bF	positive
Work Twp	bF	positive
Sydney Lake	jP	negative
Dryden District		
Langton Twp	jP	negative
Ignace District		
South of English River	jP	positive
Pike Lake	jP	positive
Pike Lake	jP	positive
Hwy 599 - km 40	jP	negative
Fort Frances District		
Hwy 11 - Mine Centre	bF	negative

[a] bF = balsam fir, jP = jack pine, wP = white pine, ScP = Scots pine

Table 12. Summary of locations sampled for the presence of the pinewood nematode in the Northwestern Region in 1986.

Location	Tree species[b]	Final identification
Red Lake District		
Graves Twp	jP	negative
Graves Twp	jP	positive
Graves Twp	bS	positive
Graves Twp	bS	positive
Graves Twp	jP	negative
McKenzie Bay Road	jP	positive
Moar Lake	bF	positive
Sioux Lookout District		
Factor Twp	jP	negative
Hwy 599 - Payne Lake	jP	negative
Hwy 599 - Savant	jP	negative
Lynxpaw Lake	jP	positive
Nanos Lake	bS	negative
Ozhuskans Rapids	bF	negative
Sioux Lookout[a]	NA	not confirmed
Stanzikimi Lake Rd	jP	negative
Williams Lake	bF	positive
Winston Lake	jP	negative
Kenora District		
Grassy Narrows Lake	jP	negative
Sabaskong Bay	rP	negative
Dryden District		
Hwy 502 - Rattlesnake Cr.	jP	positive
Mafeking Twp	jP	positive
Mutrie Twp	bF	not confirmed
Smellie Twp	jP	positive
Fort Frances District		
Hwy 502 - Cedar Narrows Rd	jP	positive
Hwy 11 - Mine Centre[a]	NA	not confirmed
McIrvine Twp[a]	jP	negative

[a] Adult *Monochamus* beetle source of collection
[b] jP = jack pine, bS = black spruce, bF = balsam fir, rP = red pine

Acid Rain National Early Warning System (ARNEWS)

An Acid Rain National Early Warning System (ARNEWS) was implemented in Ontario in 1984. As part of this program three study plots were established in Northwestern Ontario.

Each plot is monitored at intermittent intervals in the spring, summer and fall of each year to determine the visible damage caused by acid precipitation, insects and disease pathogens, as well as changes in the structure of the forest.

No visible effects of acid precipitation or changes in stand structure could be determined in the study areas this year. Insect and disease surveys carried out in the plots revealed light defoliation of black spruce by the spruce budworm and trace needle infection by the needle rusts *Chrysomyxa ledi* and *C. ledicola* in the Sandal Lake plot, Sioux Lookout District. Moderate defoliation by jack pine budworm was recorded on jack pine trees in the Mafeking Township plot, Dryden District. In the Dance Township plot, Fort Frances District, trace damage by an ocellate gall midge, *Acericecis ocellaris* (O.S.), to understory red maple (*Acer rubrum* L.) and light defoliation of understory alder (*Alnus* spp.) was caused by a leafroller, *Acleris celiana* Rob.

Monitoring by means of aerial oblique photographs, ground surveys and regular visits will continue annually.

Climatic Data

Environmental conditions such as temperature and precipitation play an important role in the development of insects, diseases and tree growth in the forest. Certain weather conditions can create favorable conditions for our forests or predispose them to damage, and can be the cause of marked fluctuations of insect populations or disease incidence. Adverse weather conditions cause abiotic damage such as frost, winter drying or scorch, breakage due to wind, snow or hail damage and drought. Weather data for three locations across the region are recorded in Table 12. This table includes the monthly mean temperature, total precipitation and 1986 deviation from the normals.

More detailed weather information can be obtained from local Atmospheric Environment Service weather bureaus.

Table 13. Summary of the mean temperature and total precipitation of three locations in the Northwestern Region in 1986.

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal[a]	Actual		Normal[a]	Actual	
Sioux Lookout Airport	January	-19.4	-16.0	+3.4	36.0	52.0	+16.0
	February	-15.7	-14.4	+1.3	27.6	42.5	+14.9
	March	-8.3	-4.9	+3.4	35.0	19.4	-15.6
	April	1.4	4.5	+3.1	45.2	106.9	+61.7
	May	9.2	12.7	+3.5	65.8	39.7	-26.1
	June	15.2	14.4	-0.8	91.7	68.8	-22.9
	July	18.3	19.2	+0.9	93.7	84.8	-8.9
	August	16.6	16.3	-0.3	88.3	68.1	-20.2
	September	10.7	9.7	-1.0	81.6	149.2	+67.6
	October	4.7	3.4	-1.3	64.9	42.1	-22.8
	November	-5.3	-9.0	-3.7	49.9	73.7	+23.8
	December	-15.1	-10.5	+4.6	33.7	22.1	-11.6
Kenora Airport	January	-18.5	-13.9	+4.6	28.2	20.0	-8.2
	February	-14.4	-13.2	+1.2	23.0	27.0	+4.0
	March	-7.1	-3.5	+3.6	30.1	22.6	-7.5
	April	2.7	5.5	+2.8	41.9	93.4	+51.5
	May	10.5	14.6	+4.1	57.3	24.8	-32.5
	June	16.1	16.6	+0.5	83.4	80.0	-3.4
	July	19.2	19.6	+0.4	91.8	104.9	+13.1
	August	17.6	17.0	-0.6	85.9	64.2	-21.7
	September	11.6	11.2	-0.4	69.2	102.2	+33.0
	October	5.6	5.0	-0.6	40.7	18.0	-22.7
	November	-4.6	-8.4	-3.8	40.4	59.5	+19.1
	December	-14.1	-9.9	+4.2	31.2	15.4	-15.8

(cont'd)

Table 14. Summary of the mean temperature and total precipitation at three locations in the Northwestern Region in 1986 (concl.).

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal[a]	Actual		Normal[a]	Actual	
Fort Frances Airport	January	-16.9	-13.5	+3.4	30.6	36.0	+5.4
	February	-13.1	-12.7	+0.4	22.7	36.8	+14.1
	march	5.7	-2.5	-8.2	31.6	9.0	-22.6
	April	3.8	6.1	+2.3	48.5	117.4	+68.9
	May	11.0	12.9	+1.9	71.2	23.4	-47.8
	June	16.4	15.6	-0.8	101.7	101.1	-0.6
	July	19.2	20.0	+0.8	103.6	65.4	-38.2
	August	17.7	16.1	-1.6	82.6	68.7	-13.9
	September	12.2	11.4	-0.8	83.8	91.0	+7.2
	October	6.6	5.8	-0.8	50.9	18.4	-32.5
	November	-3.2	-5.9	-2.7	36.8	50.2	+13.4
	December	-12.4	-8.4	+4.0	31.8	20.4	-11.4

[a] Normal temperature and precipitation are based on the period 1930-1980.